Corporate Finance

This textbook on Corporate Finance deals with the different sources of funding and the capital structure of corporations (excluding financial institutions), the decisions that managers can take to increase enterprise value as well as the tools and analysis used to allocate financial resources.
The authors link theoretical insight to practical cases. The objectives and functions of corporate finance are discussed in an introductory chapter. The following chapters cover: fundamental financial valuation principles, investment analysis and the minimum investment return requirement, capital structure and dividend policy, long-term and medium-term financing, working capital as well as some specific financial topics such as valuation of companies, international financial policy, financing of growth companies, mergers and acquisitions, etc.
While written for students, this book is also appealing to financial professionals such as financial directors, credit rating agencies, corporate managers in financial institutions as well as accountants and auditors.

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Marc Deloof, Sophie Manigart, Hubert Ooghe en Cynthia Van Hulle

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intersentia
Cambridge – Antwerp – Chicago

Intersentia Ltd
Sheraton House | Castle Park
Cambridge | CB3 0AX | United Kingdom
Tel.: +44 1223 370 170 | Fax: +44 1223 370 169
Email: mail@intersentia.co.uk
www.intersentia.com | www.intersentia.co.uk

Distribution for the UK and Ireland:
NBN International
Airport Business Centre, 10 Thornbury Road
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6 Assessing investment projects

Introduction

So far, we have determined the economic value of financial instruments such as shares, bonds and options. This chapter will assess the value of investment projects in the real economy: is it economically interesting for a company to carry out an investment project? Does a project create value for the company and for the shareholders?

An investment project requires the spending of a certain amount today, in the hope of receiving greater – but uncertain – amounts in the future thanks to the project. This chapter examines the relevant cash flows and how current and future cash flows can be compared to determine the rate of return on an investment project.

Once again, as is always the case in financial decisions, cash flow is used, and not accounting profit figures. In determining the value of a share, the present value of the dividends expected in the future is calculated, taking into account the required shareholder rate of return. To know the value of a bond, the total value of the future interest and the nominal value of the bond at the end of the term are recalculated towards today. After all, dividends, interest and nominal value are the income that investors receive. The same principle applies when assessing investment projects: the value of a project is defined as the current value of all the cash flows generated by the project, taking into account the required rate of return on the investment project. This chapter assumes that the required rate of return is known. Determining the required rate of return is discussed in chapter 8. First, a detailed examination is made of how the relevant cash flows are determined. Then, the prevailing investment assessment techniques are discussed. Chapter 7 deals in more detail with a number of advanced aspects, such as inflation and options in investment projects.

6.1. Determining cash flows

6.1.1. General basic principles

To determine the economic value of an investment project, all cash flows generated by the project must first be identified. Only those cash flows generated by the project are eligible, but care must be taken to ensure that all cash flows are considered. This principle is simple, but in practice this is the most difficult phase in assessing the value of an investment project.

The basic principles:

– Only cash flows (income and expenses) are relevant, not accounting loss or profit figures. Revenues and costs should be considered only to the extent that they entail income and expenses;

- Only the cash flows generated by the project are important. We call these the marginal or incremental cash flows. Cash flows that are independent of whether or not the project is executed, are irrelevant to the investment decision;
- No account is taken of financial flows (such as interest payments on or the repayment of loans, or dividends on new capital) when determining cash flows, but only of operating flows. The financing cost, after all, will be taken into account when determining the minimum required rate of return. Whether an investment project is financed with a new loan, with surplus liquid assets or with newly issued share capital is therefore irrelevant;
- However, the effect of the investment project on taxes *is* taken into account, since paying taxes results in an outgoing cash flow. The relevant tax rate is the marginal tax rate, not the average tax rate of the company. After all, the extra profit of the project will be taxed at the marginal tax rate – i.e. the highest rate to which the company is subject – and not at the average tax rate.

Before fleshing out these basic principles using examples, some pitfalls that often occur in practice are considered.

6.1.2. Sunk costs

A 'sunk cost' is an expense that happened in the past. Since expenses that have been incurred in the past cannot be reversed, and therefore cannot be influenced by the decision whether or not to invest (further), they are not expenses caused by the project and should not be taken into account.

Example 1
The company *Pharmaceutica* has already invested ten million euros in research and development into a specific new drug. The drug was successfully tested on animals. Before being allowed to market the drug, it needs to be further tested on healthy people to determine its side effects. If this phase is successfully completed, it must still be tested on sick people to check whether it effectively fights the intended disease. These two test phases in turn require investments of millions of euros. When deciding whether or not to start the next test phase, the research work already performed is irrelevant. These expenses have been incurred in the past and therefore have no effect on the future investment. It is the future that is important. What is the probability of successfully completing the following test phases? If the drug is finally put on the market, what is the estimated market size, sales price, etc.?

Example 2
The company *Orient Exploder* is considering an opportunity to take over the Chinese fireworks market. Last year it built a first test factory and sold its fireworks on the local market. This of course was a significant investment. However, the test showed that professionally produced fireworks are too expensive for the local population, which prefers cheaper (but more dangerous) fireworks. *Orient Exploder* sees no possibility of reducing

production costs. The fact that the test investment was substantial does not affect the decision whether or not to continue with the Chinese project. Only future investments, future expenses and future income are important. The test investment was a good way to get to know the market, but the expenses already incurred in the past are irrelevant to the current decision whether or not to invest in expansion. The decision to build a test factory was of course an investment decision. Moreover, it was not *a priori* a bad decision, even if it later turns out that the follow-up investment will not take place. After all, the initial investment made it possible for *Orient Exploder* to better understand the market and gather essential information to properly assess the further investment.

6.1.3. Opportunity costs

A company owns an asset (for example a piece of land or a building) that will be used in an investment project. If the project is executed and the resource used, an alternative use is excluded. Potential revenue from a different use is therefore lost. The use of the resource therefore represents an opportunity cost, because the company loses the alternative revenue from the assets if the project is executed. Opportunity costs must therefore be taken into account in the investment project, even if they do not entail immediately visible cash implications.

Example
A company has long owned an unused storage space in the South of France, with an estimated resale value of 1 million euros. It has a project to develop the Southern European market. In this project, the storage space is used as a place to hold intermediate stock in the vicinity of the Southern European market. Should the value of the storage space be included in the assessment of the investment project?
Yes, the fact that the storage space has long been in the possession of the company is irrelevant here. If the project is implemented, the storage space can no longer be used for other purposes. The most obvious alternative is the sale of the storage space for 1 million euros. Hence the current market value of the storage space must be considered as an expense at the start of the project. After all, if the project is not implemented, the land and storage space can immediately be sold for 1 million euros and the company receives an immediate income from its sale.

6.1.4. Side effects

Another difficulty in determining the incremental cash flows is the fact that the change in cash flows throughout the entire company must be taken into account. For example, the introduction of a new product may have a negative impact on sales of other products in another department of the same company. When assessing this "introduction of a new product" project, this negative consequence must be fully taken into account.

6.1.5. The useful life of the project

The relevant expected life over which the cash flows must be determined is the economic life of the project. The tax life (over what period will the investment be depreciated?) is irrelevant. If the investment still generates cash income and expenses after the depreciation period, these must also be taken into account.

6.2. Example: an expansion investment

In order to flesh out the foregoing, an example is elaborated below. *Newprod PLC* is considering the introduction of a new product. In order to get to know the market of the new product, a short market survey has already been carried out by an external agency, for which 20 000 euros were paid. Based on this study, additional sales are expected as shown in Table 6.1. This projection is based on the volumes that are expected to be sold and the expected selling price per unit. It is also expected that the product will remain on the market for five years. To launch the new product, an investment in a completely new production hall with equipment and a marketing campaign is necessary. The production hall will be built on land for which *Newprod* paid 100 000 euros five years ago. The presumed resale value of this land is now 150 000 euros. The expected lifespan of the production hall is 33 years, the lifespan of the equipment is five years.

In order to produce and distribute the new products, raw materials and consumables, services and other goods must be paid for, as well as wages, salaries and other costs; these amounts are shown in Table 6.1. Customers are expected to pay after an average of 30 days, and suppliers will be paid within the same time frame. Stock equivalent to two weeks of sales must be maintained. At the end of the five-year period, the stock will be phased out, all suppliers will be paid, and all outstanding customer receivables will be collected.

Is this an interesting opportunity?

Table 6.1. Cash flows from the investment project (all amounts in 1 000 euros)[17]

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Impact on the result of the company						
(1) Revenue		100.0	180.0	250.0	250.0	120.0
(2) Raw materials and consumables, services and other goods		–40.0	–72.0	–100.0	–100.0	–48.0
(3) Wages and salaries		–20.0	–22.0	–22.0	–22.0	–18.0
(4) Depreciation		–72.0	–72.0	–72.0	–72.0	–72.0
(5) Operating profit before taxes[1] = (1) + (2) + (3) + (4)		–32.0	14.0	56.0	56.0	–18.0
(6) Additional taxes: 40% marginal tax rate		12.8	–5.6	–22.4	–22.4	7.2
(7) Operating profit after taxes = (5) + (6)		–19.2	8.4	33.6	33.6	–10.8
Operating cash flows						
(8) Operating cash flow after taxes (7) – (4)		52.8	80.4	105.6	105.6	61.2
(9) Change in working capital requirement		–6.5	–5.3	–4.5	0.0	16.3
(10) Inventories		*1.5*	*2.8*	*3.8*	*3.8*	*0.0*
(11) Trade receivables		*8.3*	*15.0*	*20.8*	*20.8*	*0.0*
(12) Supplier credit		*3.3*	*6.0*	*8.3*	*8.3*	*0.0*
(13) Need for net working capital (10) + (11) – (12)		*6.5*	*11.8*	*16.3*	*16.3*	*0.0*
Investment cash flow						
(14) Equipment	–300.0					
(15) Production hall	–400.0					339.4
(16) Land	–150.0					150.0
(17) Market research	–					
(18) Total (initial) investment (14) + (15) + (16) + (17)	–850.0					489.4
Free cash flow (8) + (9) + (18)	**–850.0**	**46.3**	**75.1**	**101.1**	**105.6**	**566.9**

[17] Operating profit before taxes is also called EBIT (Earnings Before Interest and Taxes).

6.2.1. Determining the impact on the annual result

Although the value of the project has to be assessed on the basis of the cash flows, measuring the impact of the investment on the annual operating results is nevertheless started, since this determines how taxes (which do indeed generate a cash flow) are influenced by the project.

The budgeted surplus revenues and additional costs are shown in Table 6.1. Sales of the new products in the first year are not yet up to speed. Only in year 3 and 4 are top sales expected. Sales decline during the fifth year, at the end of the project's life. The raw materials and consumables as well as services and other goods are variable and follow the sales. Wages are partially variable, but also partially fixed, which explains why wages do not rise or fall as much compared with sales. Depreciation, i.e. the sum of the annual depreciation of the building and equipment, is of course fixed.

There are more costs than revenue in the first year, which affects the result negatively. Thus *Newprod PLC* will pay less taxes (assuming that the company as a whole realises more than 32 000 euros in operating profit). The decreased amount of taxes represents an opportunity revenue for the current investment project. The same situation occurs in year 5, when sales are lower, but fixed costs (such as depreciation) continue. In years 2, 3 and 4 there are more revenues than costs, so that more taxes will have to be paid.

Note that possible financial costs are not taken into account. Financial costs are included in the minimum required rate of return on the investment.

6.2.2. Determining the change in the need for net working capital

The annual operating cash flow after taxes is equal to the annual operating results after taxes, plus the non-cash costs, in this example equal to the depreciation. Thus in year 1, net operating cash flow amounted to 52 800 euros. However, this amount was not fully received in year 1. *Newprod PLC* will need additional net working capital if the project is executed.

Because sales are only paid after 30 days, not all revenue is income from that same year. The outstanding customer receivables at the end of each year therefore amount to one twelfth of the total sales, assuming that the sales are spread evenly over the year. In addition, a stock of products will be created, equivalent to two weeks of sales. At the end of each year there will be stock equal to one twenty-sixth of the cost price of the goods (estimated at 40% of the sales price). This stock must be purchased and paid for. This is therefore also an investment for *Newprod PLC* attributable to the project. The expenses related to raw materials, auxiliary materials, services and other goods are

also not paid immediately: suppliers grant an average payment extension of 30 days. The need for net working capital is created by the stock, increased by the customer receivables and reduced by the supplier payables.[18]

The annual increase in the required net working capital is an investment. Holding more working capital means that extra cash resources are invested in the operation of the company. On the other hand, a decrease in the net working capital requirement is equivalent to a divestment: there is additional cash revenue due to the reduction of inventories and customer receivables. At the end of the project's life (year 5), the net working capital is fully reduced. Since there will no longer be sales after year 5, there will also be no stock, no customer receivables and no supplier credit. In year 5, therefore, there is an extra cash flow thanks to the reduction of the working capital requirement.

6.2.3. Determining investment cash flows

The initial investment is caused by the construction of the production hall, the purchase and installation of the equipment and the opportunity cost of the land on which it is built. The purchase and installation of the equipment is estimated at 300 000 euros. This amount includes all the additional expenditure that this entails, such as adjustments to other production entities, staff training, etc. The equipment is depreciated on a straight-line basis over 5 years, the lifespan of the equipment.

Construction of the production hall costs 400 000 euros; the building is depreciated on a straight-line basis over 33 years. Since the building (unlike the equipment) is still usable at the end of the project, the residual value of the building must be taken into account. The probable residual value of the building is equal to its book value after 5 years.[19] Annual depreciation for the building amounts to 400 000 euros / 33 = 12 121.21 euros. After 5 years, the carrying amount of the building is therefore equal to 339 393.94 euros. This amount is considered a positive cash flow for the current project. After all, if the project is executed, the building can be used for other projects after 5 years or sold for – presumably – the book value. The market value of all remaining assets at the end of the project's life can thus be considered as an income that benefits the project.

Account is taken of the value of the land: 150 000 euros. This is an opportunity cost that must be charged to the project. The fact that 100 000 euros were paid in the past for the land is irrelevant. The past is not important for the current investment decision.

[18] If there are other operating debts, such as debts in relation to staff or social security contributions, these must also be taken into account. These debts also reduce the need for net working capital.

[19] If the probable market value differs from the book value, the tax effect must be taken into account. In the case of a capital loss, there will be a tax advantage; in the case of a capital gain, a tax disadvantage.

If the project is now implemented, the land can no longer be used for other purposes or sold. Sale of the land would yield 150 000 euros, making this amount the relevant opportunity cost. Like the building, however, here too, the land still has a value at the end of the project. Land is not depreciated; it is assumed that the probable market value after 5 years will be unchanged compared to the value today.

Note that the cost of the market research is not taken into account. After all, this is a sunk cost that happened in the past and is irreversible. Whether or not the investment project is carried out, has no longer impact on the expense caused by this market research.

The free cash flow related to the investment project consists of the sum of the operating cash flow after taxes, the change in the need for net working capital, and the investment cash flow.

Free cash flow = Operating cash flow after taxes
+ Change in net working capital requirement
+ Investment cash flow

6.3. Evaluation methods

Once the free cash flows of the project have been determined, it must be determined whether the investment creates or destroys value. In what follows, the most commonly used techniques to assess investments will be discussed and evaluated.

6.3.1. Average book profitability

Definition

The average book profitability is the average annual after-tax profit generated by the project divided by the average carrying amount of the investment over the life of the project.

$$\text{Average book profitability} = \frac{\text{Average annual after-tax profit}}{\text{Average carrying amount of the investment}}$$

Applied to the above example:

$$\text{Average book profitability} = \frac{(-19+8+34+34-11)/5}{(850+778+706+634+562+489)/6} = 1.4\%$$

Book profitability is compared to the minimum rate of return required, to determine whether or not the project will be accepted.

Objections

- this method is based on profit and not on cash flows;
- it does not take into account the timing of cash income and expenses;
- it is not clear what a correct book profitability requirement should be.

For all these reasons, it is not advisable to use average book profitability as an evaluation method.

6.3.2. Payback period

Definition

The payback period is the number of years necessary to recoup the initial investment. Applied to the example, this is 5 years: it is only at the end of the project's life that the initial investment is fully recuperated. If the annual cash flows are constant, the payback period is equal to:

$$\text{Payback period} = \frac{\text{Initial investment}}{\text{Annual net cash receipts}}$$

If the payback period is less than or equal to the maximum permitted payback period, the project is accepted. If not, it is rejected.

Objections

- this method does not take into account the cash flows after the end of the payback period;
- it does not take into account the size and timing of the cash flows during the payback period.

Despite these objections, the payback period is often used in practice, usually in addition to other, more advanced methods. This method provides a certain insight into the risk and liquidity of a project: the shorter the payback period, the smaller the risk and the greater the liquidity of the project. However, it should be noted that this method does not include the distribution of the possible outcomes in the analysis and therefore cannot be considered as a good risk indicator. The payback period therefore is better used as additional information, rather than as a rate of return criterion to be maximised.

In some companies, a number of the above-mentioned objections are met by using a "discounted" payback period. In this case, each of the future cash flows is first recalculated, taking into account the required rate of return on the investment project. These discounted cash flows serve as the basis for determining the payback period as

above. The discounted payback period will always be slightly longer than the regular payback period.

While the discounted payback period seems more attractive, the most fundamental objections to the payback period remain. Here too, an arbitrary cut-off point must be determined, and all cash flows after the payback period are ignored.

6.3.3. Internal Rate of Return (IRR)

Definition

The methods based on discounting cash flows take into account the size and time pattern of the cash flows of an investment project and can therefore be regarded as more objective evaluation methods. The two methods that are based on discounting are the internal rate of return method and the net present value method.

The internal rate of return is the interest rate that equates the present value of the expected cash receipts to the present value of the expected cash outflows.

$$A_0 + \frac{A_1}{(1+r)^1} + \frac{A_2}{(1+r)^2} + \cdots + \frac{A_n}{(1+r)^n} = \sum_{t=0}^{n} \frac{A_t}{(1+r)^t} = 0 \qquad \textbf{[6.1]}$$

With A_t = incoming or outgoing cash flow in period t
r = internal rate of return.

In certain (exceptional) situations, more than one internal rate of return is possible. The problem of multiple internal rates of return is discussed at the end of this chapter.

Example

$$-850 + \frac{46}{1+r} + \frac{75}{(1+r)^2} + \frac{101}{(1+r)^3} + \frac{106}{(1+r)^4} + \frac{567}{(1+r)^5} = 0$$

From which it follows: IRR = r = 1.3%

Finding the appropriate value for r cannot be solved using a closed mathematical formula, but must be solved through trial and error. Every spreadsheet and advanced calculator has an IRR financial function that automatically calculates the internal rate of return for a series of cash flows.

Use

If the internal rate of return is greater than the *a priori* determined required rate of return on the investment project, the project is accepted. If not, it is rejected.

Meaning

The IRR method answers the question: "what rate of return does an investment project have on the invested capital?" Applied to the example, this means that the originally invested capital of 850 000 euros will earn a 1.3% rate of return over 5 years.

6.3.4. Net Present Value Method (NPV)

Definition

The net present value method determines the present value of all cash flows of an investment project, given a minimum rate of return, after taxes, required for the investment project:

$$NPV = A_0 + \frac{A_1}{(1+k)^1} + \frac{A_2}{(1+k)^2} + \cdots + \frac{A_n}{(1+k)^n} = \sum_{t=0}^{n} \frac{A_t}{(1+k)^t} \quad \textbf{[6.2]}$$

with NPV = net present value
k = required minimum rate of return

If the net present value is greater than or equal to 0, the project is accepted. If not, it is rejected. This can also be expressed in the following way: a project is accepted (rejected) if the present value of the cash receipts is larger (smaller) than the present value of the cash outflows. If the NPV is positive, this means that the future cash flows are worth more than the initial investment expenditure, taking into account a predetermined required rate of return on the investment. The NPV of a project shows how much value the project creates for the shareholders, in addition to the minimum required rate of return.

Example (with k = 10%)

$$\begin{aligned} NPV &= -850 + \frac{46}{1+0.10} + \frac{75}{(1+0.10)^2} + \frac{101}{(1+0.10)^3} \\ &\quad + \frac{106}{(1+0.10)^4} + \frac{567}{(1+0.10)^5} \\ &= -246\,000 \text{ euros} \end{aligned}$$

The project is not accepted since the net present value is negative.

Meaning

The net present value of an investment project indicates how much value the project creates for the company. After all, it is the value of the future cash flows, taking into account the *a priori* required rate of return. With a positive net present value, the initial investment earns the required rate of return during the project's life, and on top of that, value is created equal to the net present value. In the example, value is destroyed if the project is executed: the net present value is negative.

6.4. Comparison of net present value and internal rate of return

Both the internal rate of return and the net present value method take into account all the cash flows of an investment project till the end of the project, and the time value of the money. Thus both methods are clearly preferable to those based on the average book profitability and the payback period, and therefore are often used in practice. Which of the two methods is preferred? First, this chapter will consider how both methods compare when only one project needs to be assessed, then it will look at how they compare when multiple projects need to be assessed.

6.4.1. A single project

If only one project needs to be assessed, in which the cash flows show the classic pattern of a single negative initial investment followed by positive cash flows, the internal rate of return and the net present value method lead to the same decision. Figure 6.1 shows the relationship between the required minimum rate of return k and the net present value for a "normal" investment project, in which the sum of the cash receipts is greater than the sum of the cash outflows, and in which the revenue after expenses falls.

Figure 6.1. Link between the required rate of return k and the net present value NPV

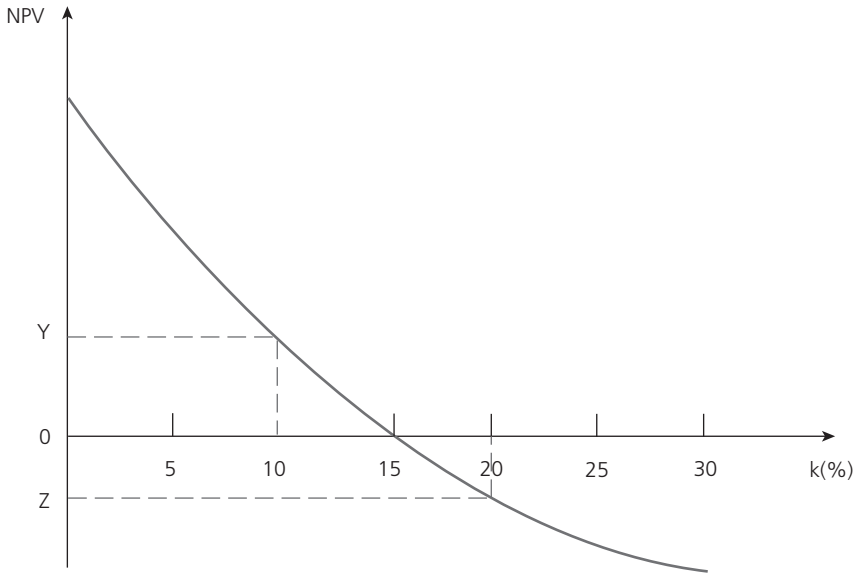


Figure 6.1 clearly shows that in this case, both methods lead to the same decision. In the example of Figure 6.1, the IRR is 15%. If the required rate of return on the project, k, is less than 15% (e.g. 10%), then the NPV is positive (for example Y) and the

IRR > k. The project should therefore be executed. If k > 15% (for example 20%), the NPV is negative (Z for example) and the IRR < k. Both methods again lead to the same decision, namely not executing the project.

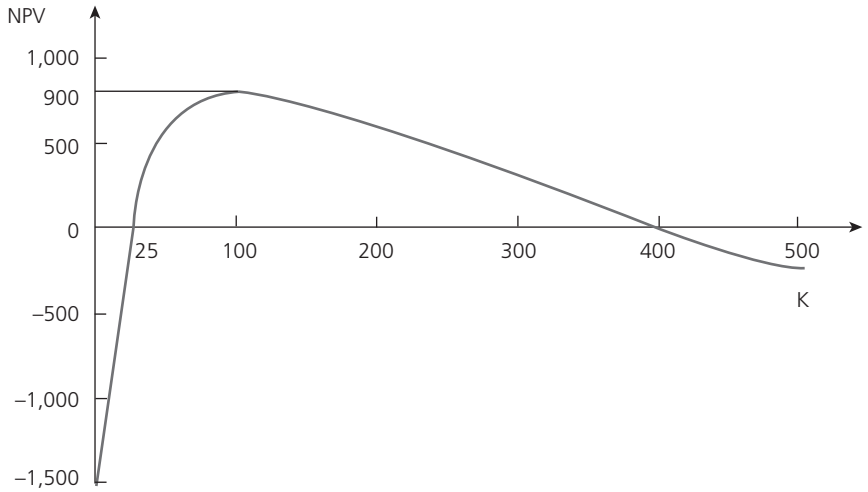
If the project shows a different cash flow pattern, problems arise with the use of the internal rate of return method. A first problem occurs when the project first generates revenues, and then expenses. A second problem arises when the cash flows of the project change sign more than once during its life.

Example: First cash flow is positive
The company *Events* organises shows and events at regular intervals. The clients or spectators pay long before the show takes place. The income is therefore collected before the expenses are paid. The company wants to see whether organising a new show is a good idea. Income is estimated at 100. Expenses are paid the following year; these are estimated at 115. The internal rate of return for this project is 15%. However, in the case of discounting factors less than 15%, the NPV is now negative, and with discount factors greater than 15%, the NPV is now positive: in this case there is a positive relationship between NPV and the discount factor. This makes sense, since the company first receives money, and later must pay money. This is comparable to obtaining a loan, which must later be repaid with interest. In this example, the IRR of 15% can be compared to the interest rate to be paid.

For projects where the initial cash flow is positive, the company obtains financing. In this case, the IRR indicates the cost of the financing. The decision rule to be used in this case is: is the IRR *less* than the minimum required rate of return? In other words, does the financing obtained cost less than the "normal" financing of the company? The decision rule in the case of the NPV method remains the same: the project creates value for the company if the NPV is positive.

Example: Cash flows change sign more than once
A company plans to operate a mine. An initial investment of 1 600 is required to open the mine. In the following year, thanks to the mining operations, a positive cash flow of 10 000 is expected. In the second year, the site will have been completely mined. At that time, however, the mine must be re-closed to prevent accidents and to comply with the relevant environmental regulations. These expenses will amount to 10 000. Are the mining operations profitable, or should we wait for higher prices for the mined metal?
Due to the sign reversal in the cash flows, mathematically this project has two IRRs, or two discount factors in which NPV = 0, i.e. IRR = 25% and IRR = 400%. Figure 6.2 shows how the NPV of this project changes in function of the discount factor.

Figure 6.2. Multiple internal rates of return



If cash flows change sign more than once during the project's life, it is a mathematical fact that there are multiple values for the discount factor at which NPV = 0. In theory, a series of cash flows with N sign changes after the initial investment can entail a maximum of N IRRs. Moreover, there can also be projects where there is no IRR.

What is the correct IRR if there is more than one? None of the multiple internal rates of return has economic significance because they are not a measure of the investment value. In this case, the IRR is only a mathematical concept, without business-economic relevance. Again in this case, the NPV results in the correct decision: invest if the NPV is positive, given an assumed required rate of return.

6.4.2. Mutually exclusive projects

Two or more investment proposals are mutually exclusive if the choice for one project excludes the other(s). For example, a company decides to expand its production capacity. For this, it can either expand an existing facility or build a factory at a new location. If a new location is chosen, the existing facility will not be expanded and *vice versa*. If a company decides to purchase a truck and can choose from more than one brand, the choice for one brand will imply that the trucks of other brands are not purchased.

In the case of mutually exclusive projects, IRR and NPV can lead to conflicting conclusions, especially if the initial investment of one project is much larger than the investment in the other project, or if the time pattern of the future cash flows differs greatly.

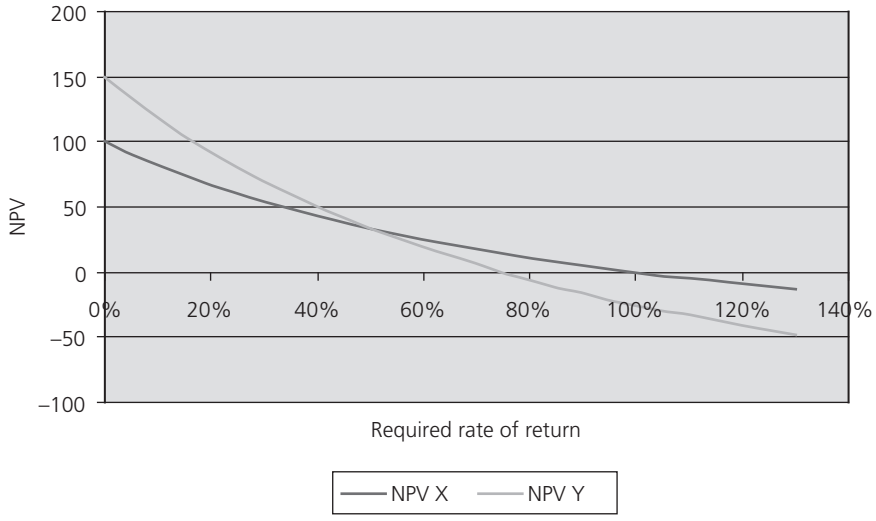
An example illustrates this. Projects A and B are mutually exclusive and have the cash flows contained in Table 6.2. The initial investment for X is 100 and for Y, 200. The minimum required rate of return on both projects is 10%. Project X generates a net present value of 82, while project Y generates a larger net present value of 118. Project X, however, has a larger IRR than project Y: 100% for X versus 75% for Y.

Table 6.2. Cash flows from two mutually exclusive projects

Project	CFo	CF1	IRR	NPV (10%)
X	–100	200	100%	82
Y	–200	350	75%	118

Figure 6.3 shows the evolution of the NPV in function of the minimum required rate of return for projects X and Y. NPV and IRR lead to opposite conclusions, given a required minimum rate of return of 10%: according to IRR, project X is more interesting, while according to NPV, project Y is more interesting. Which is the correct decision?

Figure 6.3. NPV in function of the required rate of return for projects X and Y



It is certain that one of the two projects will be carried out, since both projects have a positive NPV and an IRR that is greater than the required rate of return. The company will therefore certainly invest an amount of 100. The question that now needs to be answered is: "does it increase value to invest an additional 100 and execute project Y instead of project X?". This additional investment of 100 in year 0 will generate an additional positive cash flow of 150 in year 1. Table 6.3 shows the cash flows of project Y versus project X.

Table 6.3. Cash flows from project Y versus project X

Project	CFo	CF1	IRR	NPV (10%)
Y – X	–100	150	50%	36

When Y – X (*i.e.* the additional investment of 100 in year 0) is considered as a separate investment project with a required rate of return of 10%, it is clear that this project has an NPV of 36 and an IRR of 50%. The additional investment is clearly profitable and creates value for the shareholders. The correct decision is therefore to execute project Y and not project X. Note that the NPV of project Y is equal to the sum of the NPV of project X and of the NPV of project Y – X. The IRR of project Y is equal to the weighted average of the IRR of project X and of project Y – X. In general, the NPV of a portfolio of different projects is simply the sum of the NPV of the individual projects and the IRR of this portfolio is the weighted average of the individual projects.

Again the NPV method, not the IRR method, leads in this situation to the correct decision. Given the objective of value maximisation of the company, the NPV method is the preferred method in all circumstances. The IRR method only definitively leads to a correct decision if the cash flows do not reverse sign more than once and if a single project needs to be decided. However, in practice the IRR method is often preferred to the NPV method. A frequently heard justification for this is the fact that the IRR method would be simpler, since there is no minimum required rate of return required to calculate the IRR. This is correct. However, this explanation does not take into account the fact that, even if the IRR method is used, a minimum required rate of return must be assumed in order to decide whether or not to carry out a project. After all, the IRR must be greater than the minimum required rate of return before a project creates value for a company.

Solar panels continue to deliver value

Despite the disappearance of the federal tax reduction, the payback time for solar panels will remain 5 years and 6 months. Rien Van den Broek, business manager of RW Solar in Turnhout, explains the calculation.

Green-thinking Belgium woke up with a hangover on 1 January 2012. For the bulk of energy-saving investments, including the installation of solar panels, the popular 40 percent tax reduction had been eliminated.

'Nevertheless, the payback period for an installation of solar panels remains very acceptable for private individuals', says Rien Van den Broek of RW Solar, a company that specialises in installing solar panels. 'We owe this to the falling rates for solar installations. Today we install household installations with at least twenty panels and at least a capacity of 3 800 watt peak for 2 euros per watt peak, a rate that was unthinkable a year ago. And large industrial installations are even more cost effective. For example, we recently submitted a tender of 327 000 euros for a

247 kilowatt-peak system, fully installed, excluding VAT and AC cabling. This corresponds to barely 1.3 euros per watt peak. However, this does require an available surface area of 1 700 m².'

Lower energy bill

'Prices fell sharply last year after solar subsidies were scaled back in Germany', explains Van den Broek. 'Supply surpluses then caused rates to plummet by 20 to 25 percent. As a result, many manufacturers today produce at cost price and the rates for solar installations have fallen to a never-seen minimum.'

Due to this fall in prices, the payback period, even after the loss of the tax reduction, remains very acceptable. Compared to this considerably slimmed-down cost, there are still two indisputable financial advantages. First, the savings on the energy bill. 'All costs included (VAT, network costs, green electricity costs, fixed remuneration, etc.), a private individual easily pays 0.21 euros per kilowatt hour used. This is easy to calculate if you take a look at the energy bill', notes Van den Broek. 'At this rate, individuals who produce 3 230 kilowatt hours per year with their installation – which corresponds to an installation of 3 800 watt peak – save 678.30 euros per year (or 3 230 × 0.21 euros). This figure is based on the average consumption in Belgium.'

Renewable energy certificates

In this, the proceeds from the renewable energy certificates must also be included. For installations put into operation between 1 January and 1 April of this year, the Flemish Government will guarantee for twenty years a subsidy of 250 euros per 1 000 kilowatt-hours of electricity generated. In the production of 3 230 kilowatt hours from our example, the subsidy amounts to 807.50 euros (3.23 × 250 euros) per year. If we add that to the savings on the energy bill, we achieve a total financial yield of 1 485.80 euros per year.

Payback time

If we compare this yield with the cost of the solar installation, the result turns out to be surprisingly favourable. 'Those who have a 3 800 watt peak system installed by us at our new rates, including assembly and VAT (6%), pay 2 euros per watt peak or 7 600 euros', estimates Van den Broek. 'With an annual yield of 1 485.80 euros, this means that this investment is recouped after approximately 5 years and 6 months. After that, the yield becomes pure profit, since the renewable energy certificates are guaranteed for 20 years. And if energy prices continue to rise, the savings on the energy bill will only become greater.'

'These figures clearly show that solar installations can also be profitable without tax relief. We currently see this in the Netherlands, where there are no subsidies for solar energy. There too, solar panels have proven to be a great success, while the payback period there is around 10 years.'

Source: *De Standaard* 7 January 2012.